

## CLAIMS

1. In a target identification system wherein a housing coaxially supports a telecentric lens element near a central electro-optical element at one end of a central optical axis with the opposite end of said central axis intersecting said target, and wherein the aperture of said lens limits the small cross-section of a collimated central light beam path for transmission of information along said central axis between a first coaxial spot on said target and a second coaxial spot on said central element, the improvement comprising:

n additional electro-optical elements mounted in said housing, n being a whole number greater than zero, , regularly spaced around said central element in close proximity thereto with their n optically active surfaces in the focal plane of said lens element, the centers of said n active surfaces defining n last straight line segments of a facet axis through the center of said lens, said lens aperture limiting the size of facet beams on said last segments to said small cross-section; and

a faceted beam diverter mounted in said housing, between said target and said lens to redirect each of said facet beam axes into a series of segments including said last and at least a first segment lying in the same axial plane with said central axis, said diverter providing a facet element, having at least said small cross-section, between each contiguous pair of segments, said first segment being spaced a facet beam width from and parallel to said central axis, said central and facet beam paths thus being combined to form a relay beam path with a large cross-section  $n+1$  times said small cross-section.

2. An identification system according to claim 1; wherein:

2           said facet elements are prisms, with dielectric constants substantially  
3 greater than one, having two broad flat faces centered on said facet axis, said faces  
4 being sufficiently inclined to one another to redirect each said facet axis bilaterally  
5 between said first and last facet axes.

1    3.    An identification system according to claim 1; wherein:

2           said facets elements are inside reflective wall portions of a tubular  
3 diverter, at least twice as long as its width, coaxial with said central axis and having a  
4 regular cross-section which tapers from a large end aperture abutting and at least equal  
5 to that of said relay beam to a small end aperture abutting and substantially equal to the  
6 aperture of said lens.

1    4.    An identification system according to claim 3; wherein:

2           the inner cross-section of said diverter is circular.

1    5.    An identification system according to claim 3; wherein:

2           the inner cross-section of said diverter is hexagonal.

1    6.    An identification system according to claim 3; wherein:

2           the inner cross-section of said diverter is pentagonal.

1    7.    An identification system according to claim 3; wherein:

2           the inner cross-section of said diverter is square.

1    8.    An identification system according to claim 3; wherein:

2           the inner cross-section of aid diverter is triagonal.

1    9.    An identification system according to claim 1; wherein:

2           said housing is an opaque tube having a cross-section at least as large as  
3 said relay beam path, the end thereof nearest said central electro-optical element being

4 closed with an opaque wall.

1 10. An identification system according to claim 9; wherein:

2 the open end of said housing is covered by light stop that divides said  
3 relay beam path into  $n+1$  central and facet beam paths.

1 11. An identification system according to claim 1; wherein:

2 said facet axes include a second segment between said first and last  
3 segments;

4 said last segments extend to folding points inside said housing spaced  
5 normally half the width of said central beam path outside of said relay beam path;

6 said facets are primary and secondary thin flat reflectors having the same  
7 cross-section as said central beam path, said primary reflectors being located between  
8 said first and second segments adjacent the edge of said lens and said secondary  
9 reflectors being centered on said folding points.

1 12. An identification system according to claim 1; wherein:

2 a scanning mirror means is mounted on said housing centered on said  
3 central axis at a point near said diverter where said relay path is undiverted to scan said  
4 relay beam over said target in one or more directions.

1 13. An identification system according to claim 1; wherein:

2 a central processing means is mounted in said housing between said  
3 central electro-optical element and said opaque wall to control activation and monitoring  
4 of all of said electro-optical elements.

1 14. An identification system according to claim 1; wherein:

2 all of said electro-optical elements are laser diodes.

1 15. An identification system according to claim 1; wherein:

2 all of said electro-optical elements are photo-diodes.

1 16. An identification system according to claim 1; wherein:

2 said electro-optical elements are a mixture of laser diodes and photo-  
3 diodes.

1 17. An identification system according to claim 14; wherein:

2 said laser diodes emit different frequencies;

3 said central processing means energizes said lasers according to a  
4 pattern of different frequency signals preassigned to said target.

1 18. An identification system according to claim 15; wherein:

2 said central processing means combines the output of said diodes in order  
3 to increase the signal-to-noise ratio and contrast of their output.

1 19. An identification system according to claim 16; wherein:

2 said central processing means alternately detects and illuminates said target  
3 designating it for a preselected weapon system.

1 20. An identification system according to claim 15; wherein:

2 said central processing means spatially dithers the output of said diodes to  
3 improve the resolution of the target image.

1 21. A method for effectively increasing the f-number of a lens having an an optical  
2 axis mounted in a housing providing a lens aperture centered on said axis with area of  
3 A and which focuses a central collimated beam of light coaxial with said axis on its  
4 image plane, comprising the steps of:

- 5           A. forming an aperture in one end of said housing on said optical axis at least  
6     $n+1$  times the aperture of said lens to admit a relay beam of collimated light centered on  
7    said axis;
- 8           B. separating said beam into said central beam and  $n$  facet beams parallel to  
9    said central beam all having cross-sectional areas substantially equal to A;
- 10          C. redirecting said facet beams to pass through the center of said lens  
11   simultaneously with said central beam forming  $n+1$  light mages on said focal plane;
- 12          D. detecting said light images as electronic images;
- 13          E. combing all of said electronic images into a single electronic image; and
- 14          F. converting said single image to a light image.

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## ABSTRACT OF THE INVENTION

An apparatus and method for enhancing an image relayed by a central beam of collimated light centered on the optical axis of a lens with an aperture area of  $A$  and focused on the focal plane of the lens. The apparatus having an aperture at least  $n$  times as big as  $A$  centered on the optical axis of the lens to admit a collimated relay beam including the central beam and a diverter means for separating the relay beam into  $n$  collimated facet beams equal to the central beam, but exclusive thereof, and redirecting them through the lens aperture to produce  $n$  additional images on the same focal plane. The apparatus also including a processor with a separate opto-electronic device for each image that converts it between electronic and photonic states, the electronic images being stored in the processor.